

BOOK REVIEWS

PROGRESS IN BOTANY 43: MORPHOLOGY, PHYSIOLOGY, GENETICS, TAXONOMY, GEOBOTANY, edited by H. Ellenberg, K. Esser, K. Kubitzki, E. Schnepf and H. Ziegler, with pp. xii + 382. Berlin, Heidelberg, New York: Springer-Verlag, 1981. DM 129,00. ISBN 3-540-11091-7.

Progress in Botany, or by its alternative title, *Fortschritte der Botanik*, is not as widely known in South Africa as it should be. In these times of extreme specialisation, and fashions, it is refreshing to find such a collection of reviews which encompasses so many fields of botanical enquiry. Its special usefulness in South Africa is that it draws attention to a very broad spectrum of literature, but particularly to the views of Continental botanists, greatly facilitated by all but two of the chapters being in English.

Some reviews are very condensed, occasionally being little more than notes, whilst the best are very readable summaries spanning the work of a number of years. The references are extensive and up to date. A valuable feature is that many chapters are prefaced by notification of comprehensive new books, major surveys and bibliographies. One of the attractions of this series has been its coverage of less familiar topics, such as the chapter "Special Cytology" by E. Schnepf and the valuable guide to modern ideas in floral morphology by P. K. Endress. Two other contributions are worthy of special notice; thus Stephan Vogel gives a most readable review of work in floral biology since 1979, and Clive Jensen discusses proteins in plant evolution and systematics. A further major and valuable contribution is the wide-ranging review of the systematics and evolution of higher plants by Poppendieck, related in a stimulating and humorous style.

Geobotany, or perhaps more explicitly, vegetation science, is represented by Knapp's survey of concepts and regions, from which however Africa is noticeably absent, and, more specialised, a history of quaternary floras of E. Europe and Central Asia by Frenzel. A well written chapter of wider appeal is that by W. Schmidt, in which he provides an overview of productivity and ecosystem research, including litter and nutrient cycling, and terrestrial and aquatic biomass productivity.

The plant physiology section includes a most informative and comprehensive essay by Amesz on the photosynthetic reaction centre. Ideas on the metabolism of organic acids are examined by Kluge, and of inorganic nitrogenous compounds by Kessler, and secondary products by Schütte. The section is concluded by a short review of recent papers on the metabolism and mode of action of gibberellins, brassinolide and cytokinins. The excellent genetics section is of much wider scope than is usual in purely botanical reviews. Nagel deals with aspects of DNA replication, Binding and Nehls with recombination in higher plants, including protoplast fusion, and Gottschalk with mutation and mutagenesis. The genetics of storage protein and regulation of gene expression is reviewed by Bläich, and Hagemann and Börner give a useful account of advances in plastid inheritance.

Many of the articles, although giving extensive references, are not very critical. Robard's summary of the present state of knowledge of plastid structure and inter-relationship can only be described as terse, and Wöhrmann and Tomiuk hardly do justice to population genetics in a mere ten pages. Whether by intention or not, the

coverage of non-flowering plants with the exception of the fossil forms discussed by F. Schaarschmidt, is scanty. A more serious criticism is the inadequacy of the index: there are too few comprehensive headings, and thus the inclusion of minor interest items, to the detriment of the more probable reader interest, although one must admit that a fairly detailed contents list does to some extent compensate for this. Cross-referencing is very incomplete: thus Umbelliferae and Apiaceae, and Gramineae and Poaceae each refer to separate entries, but not to any in common. More slipshod is to allow "legumes" to stand in the text and index for the family name, and needless to say there are unrelated page references to Fabaceae and to each of the tribes of the Leguminosae! Editorial shortcomings (or is it editorial superfluity?) also lead in places to language awkwardness, and to a number of spelling errors.

Progress in Botany is published annually. The book is offset from typescript but the layout is clear and not unpleasing. There is a strong and attractive binding and by current standards the price should not be regarded as excessive. This is a valuable source of reference and the acquisition of the series can be emphatically recommended to all botanical libraries catering for undergraduate and research interests.

A. R. A. NOEL

BIOLOGY OF PLANTS, by P. H. Raven, R. F. Evert and H. Curtis, with pp. xvi + 686, 3rd edition. New York: Worth Publishers Inc., 1981. US \$19.95. ISBN 0-87901-132-7.

Botany: An Introduction to Plant Biology by Weier *et al.* (Wiley), the 6th edition of which appeared this year, has for the past two decades been one of the best and one of the most popular textbooks of plant biology. However, it most certainly has found a rival in the 3rd edition of *Biology of Plants*, whose 2nd edition predecessor made a successful debut when R. F. Evert of the University of Wisconsin joined as second author.

I would agree with reviewer R. A. Quatrano (*Nature* **295**: 471, 1982) that this text must be "considered as one of the best overall books of general botany." From cover to cover—in fact including the cover which features a reproduction of Vincent van Gogh's *Irises*—it becomes abundantly clear that considerable teaching and professional experience has gone into a skilfully planned and comprehensively written text. Not only have the personal experiences of Raven and Evert themselves been brought to bear, but also those of many of their colleagues at a number of U.S. universities and even as far afield as Australia, Great Britain, the Federal Republic of Germany and South Africa. About 10 botanists assisted with material, discussions, guidance, and revisions of certain chapters, and nearly 50 others supplied information of various kinds.

Few textbooks can be as well illustrated, either photographically or diagrammatically, and extending colour photomicrography to angiosperm anatomy will ensure that the internal architecture of the plant is viewed afresh. While referring to anatomy, it is fair to point out that Prof. Evert's hand is clearly evident in the presentation of the plant cell, the angiosperm plant body's structure and development, and the morphology generally. This also applies to the detail and superb quality of his light and electron micrographs.

In all there are eight major sections with a total of 30 chapters, four appendices (chemistry, metrication, classification of organisms, geologic eras), a 26 page double-column glossary, and a 17-page four-column subject index. An interesting feature is the *essay*, a factual review of a topical, novel or perplexing phenomenon, written succinctly and italicized for ready identification. Only nine of the 30 chapters have no special essay, but then some have two or more, making a total of 47 (as compared to 33 in the 2nd edition). Chapter 11 on the Procaryotes includes no less than 7 essays on subjects such as genetic engineering, mycoplasmas and viroids, to mention only three. Each chapter, furthermore, is provided with a summary and in most cases also with suggestions for further reading.

When compared to the 2nd edition the new book features a number of improvements, one of which is updated information. Examples: photosynthesis, plant growth regulators, and uptake and transport. Another is the inclusion of information relating to the rapid advancement of biology during the latter part of the 1970's. Examples: recombinant DNA, tumour-inducing plasmids, and lectins. Further improvements concern reorganisation and emphasis. Examples: the chemistry of heredity has been transferred from the plant cell section to that of genetics and evolution; under the section on diversity, the blue-green algae are treated as the cyanobacteria; slime and water moulds are included in an own chapter on heterotrophic protista; emphasis on fossil plants and progymnosperms has been increased.

How might this book serve as a teaching text? This will of course depend on the university system in question. That is, is the curriculum based on a quarter, semester or annual system? Is the course at the introductory, prerequisite, undergraduate or graduate level? Are the students botany or biology majors, or is botany a non-major subject? Is it intended as preparatory to qualifying examinations? The text would be an excellent choice in the traditional three-year, nine-course, double-major degree or the ten-course, single-major degree, where it could be adopted unchanged for Botany 1. (A practical manual and preparation compendium* are also available).

It is a good text for a semester course although here, and more particularly in a quarter course, specific chapters would have to be selected to fit the teaching schedule. However, this should not present problems as the book is so organized that topics can be assigned in any preferred combination of sequences. The text may be less well suited to a system (such as in Sweden) where undergraduate courses are numerous but of short duration. However, even in this case the book offers the student what the system often fails to provide, namely the perception, synthesis and integration of the subject.

It becomes not so much a question as to what level the book should be aimed, but rather one of whether it makes accessible the basic concepts of botany as a dynamic subject. With its depth, which is sufficient for an introductory text, and its encyclopedic breadth of subject matter on which more advanced courses in physiology, morphology and ecology could build, *Biology of Plants* is the kind of text that the student can use even without the guidance of a watchful tutor. For only US \$20,00 it is excellent value and deserves to be widely adopted.

CHRIS H. BORNMAN

* Laboratory Topics in Botany, by R. F. Evert and S. E. Eichhorn, with pp. vii + 176. New York: Worth Publishers, Inc., 1981. ISBN 0-87901-142-4.
Preparation Guide for Laboratory Topics in Botany, by S. E. Eichhorn, J. W. Perry and R. F. Evert, with pp. vi + 168. New York: Worth Publishers, Inc., 1981. ISBN 0-87901-061-4.

PLANT GROWTH REGULATORS: AGRICULTURAL USES, by L. G. Nickell, with pp. xii + 173, 29 figures. Berlin, Heidelberg, New York: Springer-Verlag, 1982. DM 47, 50, approx. US \$22,10. ISBN 3-540-10973-0.

This neatly and well produced book was not written in an attempt to present a comprehensive treatise of all the agricultural uses, or potential uses of growth substances. The author himself stresses in the preface that little attention is given to the basic research which formed the backbone for the successful exploitation of these compounds. Emphasis was rather placed on the positive results which have already been achieved by applying the obtained data in the various fields of agriculture. By setting these terms of references the author succeeded in producing a well laid-out and easy to read text which clearly indicates the tremendous advancements made in the use of plant growth regulators in agriculture over the last decades. Throughout the book the author has succeeded in maintaining a good balance between what has been achieved and what could reasonably be expected in this field in future.

The data presented is covered in 24 chapters. This may seem an unnecessarily large number but these were necessitated by the fact that the author chose to discuss the available information by plant processes which are controlled or affected by the plant hormones. This approach makes the book easy to read and both undergraduates and graduate students should benefit from it. The large number of references to which the author refers should prove of great benefit not only to students but also to intending or existing researchers in this field. For these reasons all teaching and research institutions should have this book on its shelves.

J. VAN STADEN

SILICON AND SILICEOUS STRUCTURES IN BIOLOGICAL SYSTEMS, edited by T. L. Simpson and B. E. Volcani, with pp. xvi + 587, 515 figures and 15 tables. Berlin, Heidelberg, New York: Springer-Verlag, 1981. DM 240, approx. US \$111,80. ISBN 0-387-90592-8.

Siliceous structures occur in many organisms in which amorphous hydrated silica forms cell walls, scales, tests and other skeletal features. In some groups, e.g. the diatoms, the morphology of these siliceous structures form the basis for their taxonomy. Silicon is also required for numerous metabolic processes and is essential for growth and bone development. It is, however, still not clear in what soluble form the silicon is transported and what determines the morphological pattern of siliceous structures.

An international symposium titled, "Siliceous structures and silicon deposition in living organisms", which was held in Richmond, Virginia, U.S.A., during December 1978, initiated the publication of this book.

In the preface to the book the editors state that its publication was undertaken with the dual purpose of bringing together information on the deposition by living organisms of unique skeletal structures composed of amorphous silica, and reviewing recent data on the involvement of silicon in physiological processes. The book also discusses the ultrastructural, physiological and biological aspects of silica.

Attention is focused upon the biological aspects of silica and siliceous structures, with the emphasis on the evolution, phylogeny, morphology and distribution of these structures, on the cellular aspects of silica deposition and on the physiological and

biochemical rôles of silicon. This is the first time that this wealth of data has been compiled into one volume. The field covered is therefore extensive and accordingly it is recommended as a useful reference work for workers in such diverse fields as biochemistry, botany, cell biology, diatomology, marine biology, micropaleontology, phycology, protozoology and zoology.

This is a most informative book and makes stimulating reading. The various chapters are all excellent reviews of the subjects in question. Each chapter is rich in references including the most recent (1980) at the time of going to press. Although the book covers a wide field, the editors should be complimented on their efforts to cross-reference certain features, structures, etc., relevant to the various chapters.

The book comprises 18 chapters written by experts in their relevant fields. In the introduction the editors present a brief survey of the chapters, plus notes and thoughts on morphogenesis of silica in biological systems and the evolution of silica deposition. The bulk of the book is divided into two sections:

1. *Physiological aspects of silicon*. Three chapters. Silica in cellular metabolism of diatoms, germanium-silica interactions in biological systems, and silicon in bone formation.

2. *Siliceous structures: distribution, deposition, ultrastructure and morphogenesis*. Fourteen chapters dealing with algal groups, protozoa, sponges and higher plants.

The general layout of the chapters is good with notes (where applicable) on terminology and procedures. The discussions and the posing of questions make it stimulating reading. There is some overlap between chapters 6 and 7 regarding the characteristics of the diatom cell. Although not detracting from the importance and usefulness of this book it is a pity that throughout chapter 7 the identity of the diatom referred to as *Navicula pelliculosa* is incorrect. The true identity of *N. pelliculosa* has been established in various European publications.

The book is excellently produced with only some minor spelling and printing errors. The bibliography is bounteous with just on 1 000 items in total and numbering between 23 and 108 items per chapter. In some of the chapters there appears to be some bias in favour of English language references. The chapters are well illustrated with figures of high quality. Figure captions are usually adequate and accurate but occasionally fail to give the method of photography employed. A most useful 36-page subject index, which appears to be fairly comprehensive, completes the book.

This is a highly recommended reference work for both under- and post-graduate study and should be acquired by all biological reference libraries. Unfortunately, the high price may deter individuals and specialists interested in only a section of the field covered, from purchasing this book.

F. R. SCHOEMAN

PHYSIOLOGICAL PLANT ECOLOGY 1: RESPONSES TO THE PHYSICAL ENVIRONMENT, edited by O. L. Lange, P. S. Nobel, C. B. Osmond and H. Ziegler, with pp. xv + 625, 110 figures. Berlin, Heidelberg, New York: Springer-Verlag, 1981. Volume 12 in "Encyclopedia of Plant Physiology, New Series". DM 239, approx. US \$111.30. ISBN 3-540-10763-0.

It is high time that plant biologists sorted out the difference between physiological plant ecology and plant ecophysiology. The former emphasises ecology, the latter physiology. There is obviously an area of overlap but, at least in my view, physiology

is aimed at what goes on inside a plant and ecology deals with the levels of integration above that. Failure to distinguish between the two has detracted from the value of this first part of the four volume series, since, although there are a number of interesting and informative chapters, the book is in general neither one nor the other. It is noteworthy that although the book is titled *Physiological Plant Ecology*, the editors have titled their own introductory chapter "Perspectives in Ecological Plant Physiology". This review is written from the perspective of an ecologist.

This first part of the four-part series, *Responses to the Physical Environment*, consists of 17 chapters by 22 contributors (in addition to an Introduction by the editors), making up 625 pages of well-printed and easily readable type. It has been well produced with very few errors. There are seven chapters on radiation and responses to radiation in terrestrial plants, two on the aquatic environment (one of which is specifically on light). Five chapters deal with temperature, and there is one each on wind, fire and the soil environment.

The general chapters are those which deal in some depth with the physiological responses of plants to various aspects of the environment. It is a pity that the editors did not try to achieve a more consistent framework for the chapters.

The sections on Ecological Implications, at the ends of chapters 5 and 6, were useful contributions and would have enhanced the value of the other chapters.

Chapter 8, on the aquatic environment, is too superficial to be of much use, as are the final three chapters on wind, fire and the soil environment. Each of these four topics requires a book of their own to do them any justice. Chapter 11, on micro-organisms, is out of place.

In general, the first five chapters on light and chapters 10, 12, 13 and 14 on temperature are good contributions and make the book worth-while.

The bibliographies are up to date and most of them are comprehensive. There is both an author and subject index, and the latter is well constructed. The level of the book is suited mainly for final year undergraduate and postgraduate students. However, at US \$112 it is destined mainly for libraries, where it will be a useful reference.

B. H. WALKER

HORMONAL REGULATION OF DEVELOPMENT I, edited by J. Macmillan, with pp. vi + 681. Berlin, Heidelberg, New York: Springer-Verlag, 1980. Volume 9 in "Encyclopedia of Plant Physiology, New Series", edited by A. Pirson and M. H. Zimmerman. US \$134.60. ISBN 3-540-10161-6.

This is the first of a set of three volumes in the New Series of the *Encyclopedia of Plant Physiology* intended to cover the field of plant growth substance-controlled regulation of growth and development. The planning of the three volumes was the responsibility of N. P. Kefford of the University of Hawaii. In Volume I consideration is given to the molecular and subcellular components of hormonal regulation, and a refreshing approach has been adopted. Instead of treating each class of hormone separately, an attempt is made to examine the properties and principles common to all classes. Kefford argues that such an approach allows examination of the hypothesis that differing classes of hormones, "acting according to common principles, are determinants of processes and phases in plant development". This seems a logical approach since it is assumed that the major groups of plant hormones (and

other growth-affecting substances) act separately, sequentially or in concert on the basic processes of plant growth and development. In the Introduction, the editor, J. MacMillan of the University of Bristol, presents the scope of the volume and gives a chapter synopsis in a way that makes much additional review comment seem redundant.

There are six chapters. Chapter 1 gives a brief history of the five classes of hormones, lists the individual substances, and their occurrence, and includes other constituents which affect plant growth. Chapter 2 deals with extraction, purification, and identification techniques, and presents some case histories. No mention, however, is made of ethylene, not even under the heading Identification without isolation. In chapter 3 quantitative analytical aspects are dealt with. This is a provocative chapter seeking, as pointed out by the editor, to stimulate critical appraisal of the accuracy of methods used by investigators. Again, reference to ethylene is missing. Immunological assays are mentioned briefly, although their increased use and eventual supercession of the bioassay is foreseen. (Developments in 1980 and 1981 subsequently showed that radioimmunoassay of indoleacetic acid, abscisic acid and other hormones has become a reality.)

Chapter 4 is the heart of the book, not only in its length but in its very thorough, scholarly treatment of the biosynthesis and metabolism of all five hormone classes. Chapters 5 and 6 review receptor sites and molecular effects, respectively. Finally, the book contains nearly 100 pages of author and subject indexes.

This is the kind of reference work that sells itself, even though it has been very well written, edited and produced. It probably was a major task to limit its length (681 pages compared to 1 357 of its counterpart 21 years earlier), but this obviously is a factor that has kept the costs down. The price of US \$134.60 (or \$107.70 for purchasers of Vols 9, 10 & 11) will ensure that this book finds its way also to the private bookshelf.

CHRIS H. BORNMAN

PLANT GROWTH SUBSTANCES 1979, edited by F. Skoog, with pp. vi + 527 and 209 figures, Berlin, Heidelberg, New York: Springer-Verlag, 1980. US \$57.90. ISBN 3-540-10182-9.

This volume represents the proceedings of the 10th International Conference on Plant Growth Substances held in Madison, Wisconsin in July 1979. As a proceeding's volume it is in a class of its own and one that editors of past and especially future conference proceedings would be wise to consult.

The publication has the appearance of a text book: there is uniformity of style and ample evidence that much thought and careful planning had gone into its preparation. The conference itself was organised into 11 sections, each with a chairman who was responsible for the arrangement of the topic material and the invited reports. These chairmen not only introduced the topics and led the discussions, but also assisted in the editing of the invited reports.

Each of the five classes of plant growth substances (auxins, cytokinins, gibberellins, abscisic acid and ethylene) is represented in a section. Four other closely related sections are devoted to new growth factors (this comprises a two-page summary), hormonal regulation in plant reproductive development, hormonal regulation of morphogenesis, and agricultural uses of plant growth regulators. The remaining two

sections include a historic review and a commemorative symposium. The former, under the title *Origin and development of plant growth substance research*, includes reviews respectively by J. Heslop-Harrison and K. V. Thimann on Darwin and the movement of plants and the development of plant hormone research since 1920. The latter section on plant movements was organised and presided over by A. W. Galston to commemorate the publication in 1880 of Darwin's *The Power of Movement in Plants*.

A total of 244 abstracts were submitted to the conference, but only 50 reports were accommodated in the proceedings, indicating that a strict selection procedure was applied. The papers reflect this. In the sections on the individual classes of hormones most of them report current states of knowledge, many dealing with metabolic aspects, and a number with mechanisms of action and physiological rôles in plants. In a departure from previous proceedings, the rapidly expanding practical utilisation of plant hormone research is acknowledged in separate sections on morphogenesis, reproduction and agricultural application. The section on agricultural uses of plant growth substances is one of the most interesting, for it is here that the expanding and galloping applications of gibberellin and ethylene, respectively, are considered. Within its manifold effects ethylene's influence spans all phases of plant development. As D. R. Dilley puts it: "Ethylene, indeed, is a busy gas."

As was the case with previous Plant Growth Substance Conference proceedings, that of the 10th meeting will be an essential aid to the plant hormone physiologist.

Incidentally, the 11th conference took place in Aberystwyth in July 1982.

CHRIS H. BORNMAN